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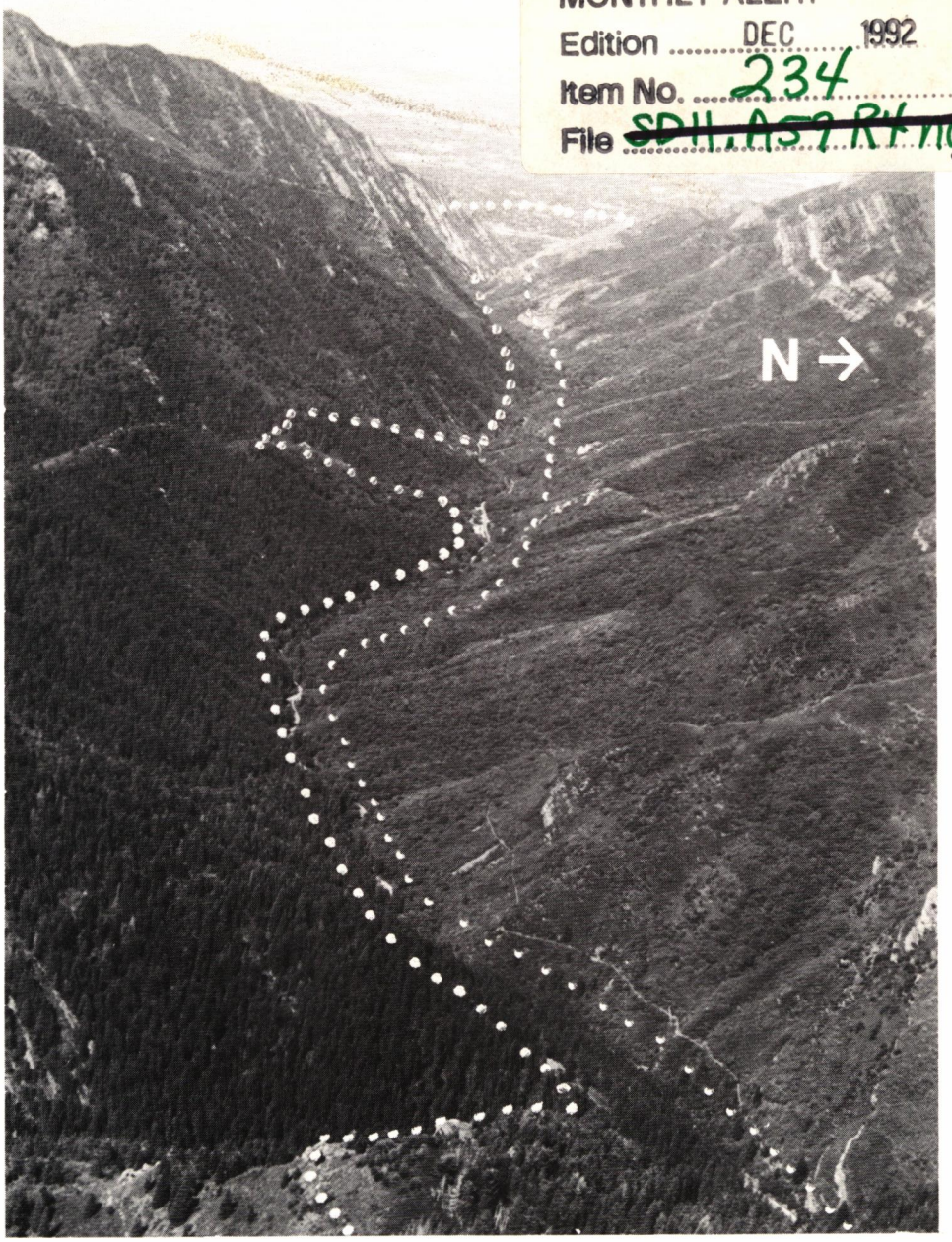
SITE CHARACTERIZATION OF GYPSY MOTH TREATMENT SPRAY BLOCKS IN UTAH, 1990

FS INFO-Intermountain
MONTHLY ALERT
Edition ..... DEC 1992
Item No. 234
File ~~SD11.A57 R4 no.90-~~ 90



FPM 90-10
October 1990

Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

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SITE CHARACTERIZATION OF GYPSY MOTH TREATMENT SPRAY BLOCKS IN UTAH, 1990

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ABSTRACT

Control efforts against the gypsy moth in Utah were undertaken on a small scale in 1989 and on a considerably larger scale in 1990. In 1990, more than 20,000 acres, separated into thirteen spray blocks along the Wasatch Front, were sprayed by a helicopter with a formulation of the biological insecticide Bacillus thuringiensis. Periodic observations were made in most of the spray blocks to identify the major trees and shrubs, their position in the canopy, and their density as they might affect aerial spray deposition. The topography and vegetation within and between the spray blocks is highly diverse with portions of blocks extending into three vegetation zones. Three general plant communities were identified: mountain brush, riparian, and residential. Some physical properties of each spray block and their vegetation type are included in this report. Aerial and ground photographs were taken to illustrate topographic features, vegetation types, and stand conditions found within some spray blocks. Recommendations are suggested for future site characterization surveys.

INTRODUCTION

The gypsy moth, Lymantria dispar, a serious defoliator of deciduous forests, was detected along the east bench of the Wasatch Mountain Range in Utah in 1988. As a first effort toward eradication, 1,190 acres were aerial sprayed in 1989. A follow-up detection program found gypsy moth life forms in other areas along the Wasatch Front, noting a considerable increase in infestation boundaries. In 1990, 20,064 acres separated into thirteen spray blocks between Bountiful and Orem, (Figure 1) were designated for aerial treatment.

The 1990 control method involved a helicopter application of Bacillus thuringiensis (Foray 48B a registered product of Nordisk Bioindustrials, Inc.) applied at three different times during May and June against feeding larva.

The gypsy moth larva are voracious feeders. They prefer deciduous trees but on occasion will feed on a wide variety of plants, including some conifers. In the East, some preferred hosts are oak, poplar, birch, willow and alder. Related species occur in abundance along the Wasatch Front in Utah. Fortunately, in Utah, a continuous tree-host type does not exist.

The Wasatch Mountain Range, one part of the middle Rocky Mountain Province, runs north and south with its western edge occurring along a fault zone, resulting in an abrupt, uplifted landscape. The range is bisected by steep, v-shaped, glaciated canyons.

There are four vegetation zones found along the Wasatch Front.[1] They are, from lowest to highest: (1) mountain brush; (2) aspen-fir; (3) fir-spruce; and (4) near alpine. Most of the spray blocks (Figure 1) fall within the mountain brush zone with parts of others reaching the aspen-fir and fir-spruce zones. Along streams bisecting those blocks and within those spray blocks oriented east-west, the vegetation is primarily riparian, i.e., growing on or immediately adjacent to stream banks. In portions of blocks within residential communities, the vegetation is much more diverse and vigorous than the native vegetation.

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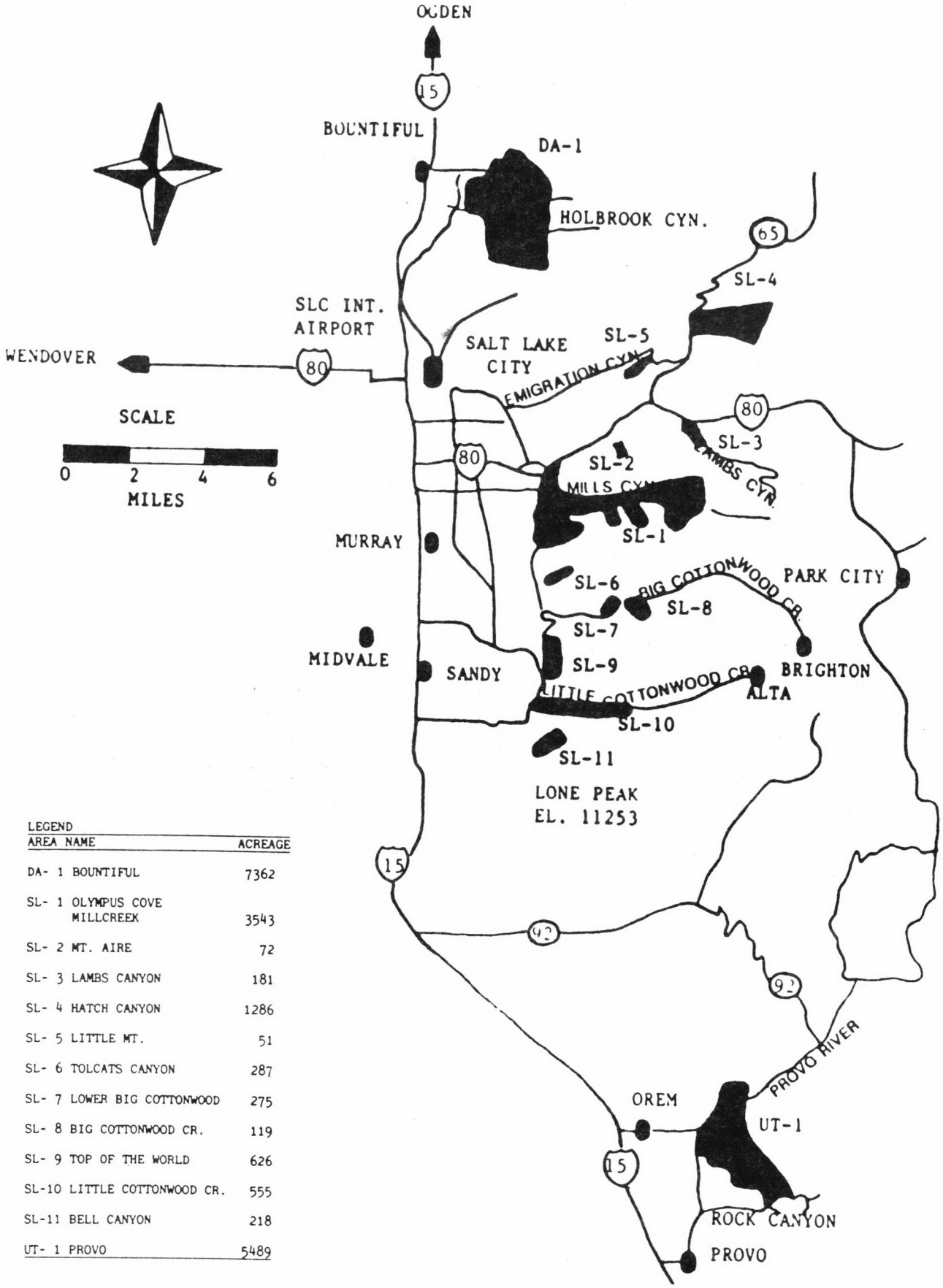
[1] Personal communication with Alma Winward, USDA Forest Service Regional (R-4) Ecologist.



LEGEND		
AREA	NAME	ACREAGE
DA- 1	BOUNTIFUL	7362
SL- 1	OLYMPUS COVE MILLCREEK	3543
SL- 2	MT. AIRE	72
SL- 3	LAMBS CANYON	181
SL- 4	HATCH CANYON	1286
SL- 5	LITTLE MT.	51
SL- 6	TOLCATS CANYON	287
SL- 7	LOWER BIG COTTONWOOD	275
SL- 8	BIG COTTONWOOD CR.	119
SL- 9	TOP OF THE WORLD	626
SL-10	LITTLE COTTONWOOD CR.	555
SL-11	BELL CANYON	218
UT- 1	PROVO	5489

FIGURE 1 - Generalized map showing gypsy moth treatment areas, Utah, 1990.

PURPOSE

The purpose of this report is to characterize the major types of vegetation occurring within the thirteen spray blocks. Observations were centered on the larger vascular plants, potential host or non-host, dominating particular areas and whose crowns occupied any portion of the canopy that would affect spray deposition and dispersion. With the exception of big sagebrush, Artemisia tridentata, which occupies large areas, no other ground vegetation (grasses and forbs) was considered.

METHODS

Due to the extreme diversity of the vascular plant vegetation and topographic conditions within and between the various spray blocks (Table 1), it was not possible within the scope of this study to conduct any type of systematic, statistically valid inventory. Instead, most of the blocks were visited, some twice, and estimates made of the major vascular plants present, their relative abundance and density, and their position(s) in the canopy. Portions of spray blocks were photographed (Figures 2-16) from the air and some photographed on the ground to illustrate examples of particular stand conditions. As part of the ground picture, a 3-meter staff was included to indicate vertical scale.

Ground observations were made between 1 and 29 May 1990 and the oblique aerial photos were taken the morning of 9 June 1990. Even at this latest date, not all vegetation had completely foliated, particularly clones of Gambel oak (Quercus gambelii), in block UT-1. The tender, new developing foliage was killed by two late frosts during late April and early May. Aspen (Populus tremuloides), and bigtooth maple (Acer grandidentatum), at the higher elevations (2,100 meters) also had not fully developed.

OBSERVATIONS

As previously stated, the vegetation and terrain within and between the spray blocks are extremely diverse; consequently only very generalized comments can be made.

A list of the major vascular plants occurring in each spray block and other physical features are given in Table 2.

The spray blocks are generally represented by three plant communities.[1] The mountain brush community is the largest of the three plant communities. It is generally characterized as having a west aspect, between 1,400 to 2,100 meters in elevation, containing continuous or scattered almost pure stands of Gambel oak, mixed with bigtooth maple, singly or in clumps and separated by

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[1] Plant community, not to be confused with vegetation zones, is "An assemblance of plants occurring together at any point in time, thus denoting no particular ecological status" (Padgett, 1989).

variable sized openings supporting sage brush, grasses, and forbs. The Gambel oak stands are relatively dense, growing as a low shrub (Figure 14), or not infrequently, as small trees. When bigtooth maple grows within or adjacent to Gambel oak stands it generally exceeds the oak in height, reaching heights of 8 meters or more (Figure 16). A lesser component of this type is Utah juniper (Juniperus osteosperma).

The riparian community is the second largest plant community and is found on or near the stream banks flowing out of the Wasatch Range. Many such streams flow through portions of the mountain brush type blocks (Figures 2 and 3), and some blocks, particularly those oriented east-west (Figures 6, 7, 8) are mainly riparian in character. At the lower elevations, in the canyon bottoms, tree canopy is diverse and somewhat laddered. Cottonwood (Populus fremontii and P. angustifolia), and box elder (Acer negundo) comprise the overstory, large growing shrubs such as bigtooth maple, western chokecherry Prunus virginiana), and river birch (Betula occidentalis) occupy the mid-canopy, and lower growing shrubs such as mountain alder (Alnus incana) and serviceberry (Amelanchier alnifolia make up the understory (Figures 5, 8, 9). Away from the stream banks on mostly steep slopes, contrasting conditions exist. The south facing slopes are primarily mountain brush while the opposite north slopes are primarily coniferous - white fir (Abies concolor) and Douglas-fir (Pseudotsuga menziesii) with small stands (clones) of aspen (Figure 7). With increasing elevation white fir and Douglas-fir yield to subalpine fir (Abies lasiocarpa).

In the suburban community, a wide variety of exotic and indigenous trees and shrubs (what one would normally expect) are found. Many of the trees are hybrids of European, Asian, and North American trees and shrubs that grow in temperate climates. Several include hybrids of maple and oak, a preferred host of the gypsy moth. Additionally, since the "east bench" residential communities are relatively new (built within the past 30 years) the trees, although fast growing, have yet to reach their mature size. Many openings - streams, sidewalks, driveways, and yards - characterize this landscape (Figure 11).

Some of these suburban communities are crossed by west flowing streams (Figure 2, 3, 5) that have, for the most part, maintained their natural riparian character. The tree canopies in these strips are denser and taller than in adjacent areas.

Table 1 - Some physical characteristics of gypsy moth spray blocks, Utah, 1990.

SPRAY BLOCK	AREA (ACRES)	ELEVATION			EXPOSURE
		LOWEST	HIGHEST	DIFF.	
DA-1	7362	4380	7300	2920	W
SL-1	3543	4840	7920	3080	W
SL-2	72	6000	6800	800	NW
SL-3	181	6000	6520	520	N
SL-4	1286	5940	7860	1920	W
SL-5	51	6040	6360	320	NW
SL-6	287	5280	8400	3120	W
SL-7	275	5050	7680	2630	SW
SL-8	119	5800	7680	1880	SW,N
SL-9	626	5000	6400	1400	W
SL-10	555	5200	6720	1520	W
SL-11	218	5040	6050	1010	NW
UT-1	5489	4800	8400	3600	NW

Vascular plants found in the gypsy moth spray blocks are as follows:

Narrowleaf cottonwood, Populus angustifolia (Pa).[1] A large, deciduous (7 to 20 meters tall) tree with a large, relatively open crown found along waterways and flood plains and occasionally on well drained soils at elevations ranging from 1,750 to 2,400 meters; commonly associated with boxelder, Acer negundo.

Boxelder, Acer negundo (An). A large, deciduous tree (12 to 20 meters tall) with a large, full crown growing along streams and bottomlands at low to mid elevations - 800 to 2,450 meters; commonly growing with narrowleaf cottonwood.

Gambel oak, Quercus gambelii (Qg). A deciduous shrub or tree (0.2 to 12 meters tall), Gambel oak is a major component of the mountain plant community along the Wasatch Front. It grows in small to large clones at elevations between 1,400 to 2,100 meters with individuals reported as high as 3,000 meters. It grows in relatively dense stands and is commonly associated with bigtooth maple, Acer grandidentatum.

Bigtooth maple, Acer grandidentatum (Ag). A deciduous bush to small tree, (4 to 8 meters tall), growing at elevations ranging from 1,280 to 2,810 meters. It is associated with Gambel oak and a principal component of the mountain brush community along the Wasatch Front.

Western chokecherry, Prunus virginiana (Pv). A widely adaptable shrub or tree 15 meters tall that grows on moderately moist slopes in association with a variety of vascular plants including sagebrush, Gambel oak and aspen.

Big sagebrush, Artemisia tridentata (At). Represented by several different varieties, 40 to 200 cm tall, big sagebrush is found at 1,220 to 2,410 meters on dry slopes throughout most of Utah. Along the Wasatch Front, it coexists with Gambel oak and bigleaf maple and numerous forbs and grasses.

River birch, Betula occidentalis (Bo). A deciduous shrub or small tree, (8 to 15 meters tall), growing on streamsides alongside narrowleaf cottonwood, box elder, and bigtooth maple, at moderately low to mid elevations - 1,200 to 2,700 meters.

Quaking aspen, Populus tremuloides (Pt). A clone-forming tree, 20 meters tall, that grows in pure stands or in association with white fir. It occupies streamsides, canyons and slopes, generally above 1,375 meters.

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[1] Letters following specific names are the code reference to that species listed in Table 2.

Mountain alder, Alnus incana (Ai). A deciduous shrub or small tree that grows along streams at mid to high elevations, 1,250 to 2,750 meters. Mountain alder is associated with river birch, and bigtooth maple.

Fremont poplar, Populus fremontii (Pf). A deciduous tree, 10 to 25 meters tall, with a broad, rounded crown, almost as broad as tall. In Utah it grows along flood plains and water courses at elevations ranging from 760 to 1,860 meters.

Rocky Mountain maple, Acer glabrum (Agl). A deciduous shrub or tree, 2 to 8 meters tall, that generally grows above 2,000 meters along tributaries with aspen and True fir (Abies spp.) on rocky slopes with mountain brush.

Serviceberry, Amelanchier alnifolia (Aa). A deciduous shrub or small tree. 1 to 5 meters tall, growing on dry or moist sites in association with sage brush, Gambel oak, aspen, and conifers at 1,500 to 2,900 meters elevation.

Blue elderberry, Sambucus cerulea (Sc). A deciduous large shrub 2 to 6 meters tall growing with sagebrush, Gambel oak, pinyon-juniper and spruce-fir at elevations ranging from 1,400 to 2,800 meters.

Ninebark, Physocarpus malvaceus (Pms). A deciduous shrub, 2 meters tall, and a member of the mountain brush community found in mesic to moist sites, along streams, in wooded areas and on open slopes at elevations ranging from 1,600 to 3,300 meters.

White fir, Abies concolor (Ac). A tree 80 meters plus in height with a full conic to rounded crown found on dry to moist north slopes with Douglas-fir, and aspen, at 1,550 to 3,050 meters elevation. It grows singly and in pure stands.

Douglas-fir, Pseudotsuga menziesii (Pm). A tree 20 to 60 meters in height with a compact, pyramidal crown growing primarily on north facing slopes at 1,550 to 3,050 meters elevation. Douglas-fir frequently grows in pure stands.

Subalpine fir, Abies lasiocarpa (Al). A tree 18 to 30 meters in height with a dense, narrowly pyramidal, spiral-like crown growing at high elevations (above 2,500 meters) in cool, moist sites. It is commonly found in association with Engelmann spruce, lodgepole pine, and aspen.

Utah juniper, Juniperus osteosperma (Jo). A spreading shrub or small tree; trunk single or many-stemmed. Grows in the upper Sonoran zone on dry, rocky slopes in pure stands or in association with pinyon pine.

Table 2 - Trees and shrubs associated with each of the 13 spray blocks, Utah, 1990.

SPRAY BLOCK	MAJOR VEGETATION TYPES (Estimated Order of Abundance)
DA-1	Qg, Ag, At, Pa, An, Pv, R[1]
SL-1	Pa, An, Qg, Ag, Ac, Pv, Pm, Bo, Jo, R
SL-2	Not Visited
SL-3	Not Visited
SL-4	Qg, Ag, At, Pa, An, Pv, Ai
SL-5	Qg, Ag, Pv, Aa
SL-6	Qg, Ag, Pa, An, Pt, Pm, At, Al
SL-7	Pa, An, Qg, Ag, Bo, Ac, Pv, Jo
SL-8	Pa, An, Bo, Ag, Pv, Ac, Pm
SL-9	Qg, Ag, At, Pa, Pf, R
SL-10	Pa, An, Bo, Ag, Pv, Ac, Pm, Pt, Qg, Ai, Agl, Sc, Pms
SL-11	Qg, Ag, Pa, An, Bo, Ac, Pm
UT-1	Qg, Ag, Pt, Ac, Pv, Pt

[1]R = residential

RECOMMENDATIONS

More detailed site characterization is recommended in anticipation of continued gypsy moth eradication projects in Utah. Because of the variable topography and diverse vegetation that will most likely be found, definitive spatial information (vertical as well as horizontal) over an entire spray block will be challenging to describe and measure. If definitive information on the effect of foliage on spray deposition is desired, specific and representative areas within certain spray blocks should be intensively characterized. This might entail choosing a small site exhibiting special vegetative characteristics, establishing spray deposition sampling stations (Kromekote samplers, etc.) at various crown levels and conducting an intensive survey of stand structure and crown density within the defined target area. Although there are standard methods for sampling vegetation (Chambers and Brown, 1983), more sensitive sampling procedures need to be developed.

Oblique aerial photographs are useful in illustrating the topography and types of vegetation that occur in portions of the spray blocks. Black and white photography is the least expensive to take and reproduce; however, it is less than ideal in showing the contrast between the different vegetation types and stages of foliage development that occur within the blocks. There is no ideal film, but in this application, color infrared film would enhance the foliage contrast as well as minimize the sometimes serious atmospheric haze problem that exists along this section of the Wasatch Front.

FIGURES

FIGURE 2 - Southeast portion of Block DA-1 showing residential areas and lower reaches of Mill Creek. Principal natural vegetation is Gambel oak, sage brush and bigtooth maple. Stream courses contain cottonwood, box elder, some white fir and several species of small deciduous trees and shrubs.

FIGURE 3 - Portion of Block DA-1 looking east into Holbrook Creek. Principal vegetation is Gambel oak (not fully foliated) and big leaf maple. Larger deciduous trees in stream bottom are cottonwood and box elder, 12-14 meters tall.

FIGURE 4 - Looking south (cave hollow) into southeast portion of Block DA-1 (see Figure 2) principal cover is Gambel oak and big leaf maple. Larger deciduous trees in foreground (Mill Creek) are cottonwood and box elder. Conifers are white fir.

FIGURE 5 - Aerial photo of lower portion of Block SL-1 (Mill Creek Canyon). Note contrast in vegetation between north facing slopes (left) and south facing slopes (right). Conifers are Douglas-fir and white fir. Gambel oak and bigtooth maple dominate south slopes. The suburban community at the mouth of the canyon (west) is also within the spray block.

FIGURE 6 - Looking west into Block SL-7 (Big Cottonwood Canyon). South slope (right) is mostly void of vegetation (Gambel oak and Utah juniper) with conifers (Douglas-fir and white fir) occupying north facing slopes. Relatively large riparian community in canyon bottom.

FIGURE 7 - Aerial photo of east half of Block SL-10 (Little Cottonwood Canyon). Canyon floor is typically riparian, dominated by cottonwood and box elder overstory. The laddered understory includes bigtooth maple, river birch, mountain alder and western chokecherry. (Figures 8 and 9). Small stands of deciduous trees near top of picture are aspen; conifer is white fir.

FIGURE 8 - In the bottom of Little Cottonwood Canyon (Figure 7). This multilevel riparian community includes cottonwood and box elder in the overstory; western chokecherry, bigtooth maple and aspen in the middle position; and river birch and mountain alder occupying the lower canopy level. Individual white firs are scattered throughout the block.

FIGURE 9 - Scene in Little Cottonwood Creek (Figure 7) showing the dense, laddered vegetation. The upper canopy is dominated by cottonwood and box elder, 15 to 20 meters tall. The taller trees are immediately adjacent to the creek.

FIGURE 10 - "East Bench" area in south half of Block SL-9. An almost "typical" mountain brush community. Ground cover in foreground is sage brush with clones of Gambel oak mixed with bigtooth maple in background.

FIGURE 11 - Example of vegetation in an established suburban community within Block SL-9.

FIGURE 12 - Portion of Block SL-11 showing suburban development along east bench. Major vegetation is Gambel oak (dense stands) and bigtooth maple. Ground cover in opening is sage brush, and small forbs and grasses.

FIGURE 13 - Aerial photo looking southeast into main part of Block UT-1. Major cover is Gambel oak with clumps of bigtooth maple and western chokecherry. Although the photo was taken 9 June, not all Gambel oak had completely refoliated, following two periods of killing frosts. Dark areas are stands of white fir.

FIGURE 14 - The principal cover in Block UT-1 (Figure 13) is this low growing, dense Gambel oak. The widely scattered deciduous trees are bigtooth maple and the conifers in background are white fir. The east spray boundary here coincides with the range of Gambel oak.

FIGURE 15 - South edge of Block UT-1, middle part of Rock Canyon. Deciduous vegetation is mainly bigtooth maple with some western chokecherry. Conifers on north slope (right) are white fir. Creek bottom is typically riparian.

FIGURE 16 - Large stands of almost pure bigtooth maple exist at higher elevations in portions of Block UT-1 (Figure 14). These trees, some exceeding 8 meters in height, have not completely foliated. Picture was taken 29 May, 1990.

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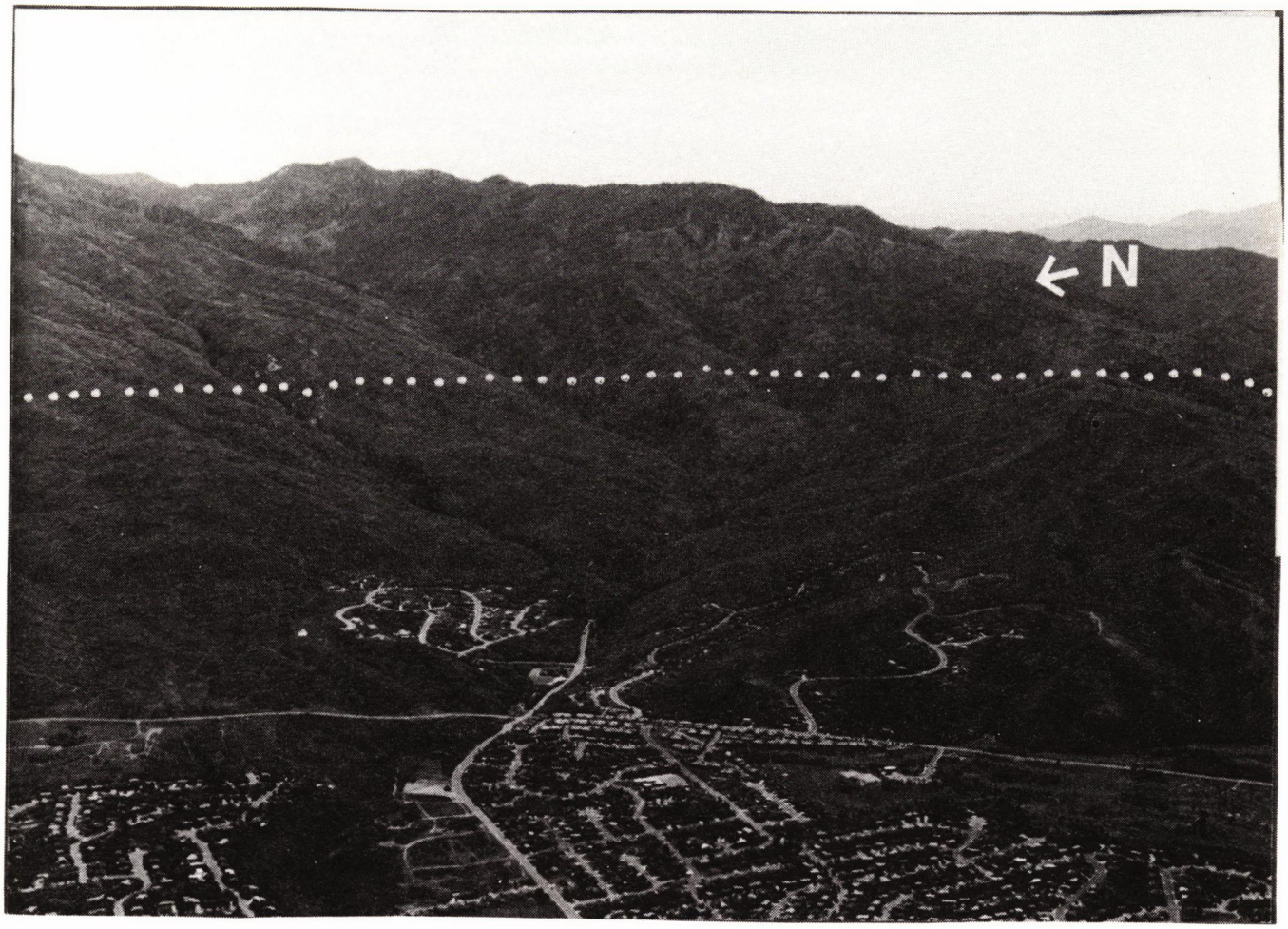

FIGURE 2 - Southeast portion of Block DA-1 showing residential areas and lower reaches of Mill Creek. Principal natural vegetation is Gambel oak, sage brush and bigtooth maple. Stream courses contain cottonwood, box elder, some white fir and several species of small deciduous trees and shrubs.

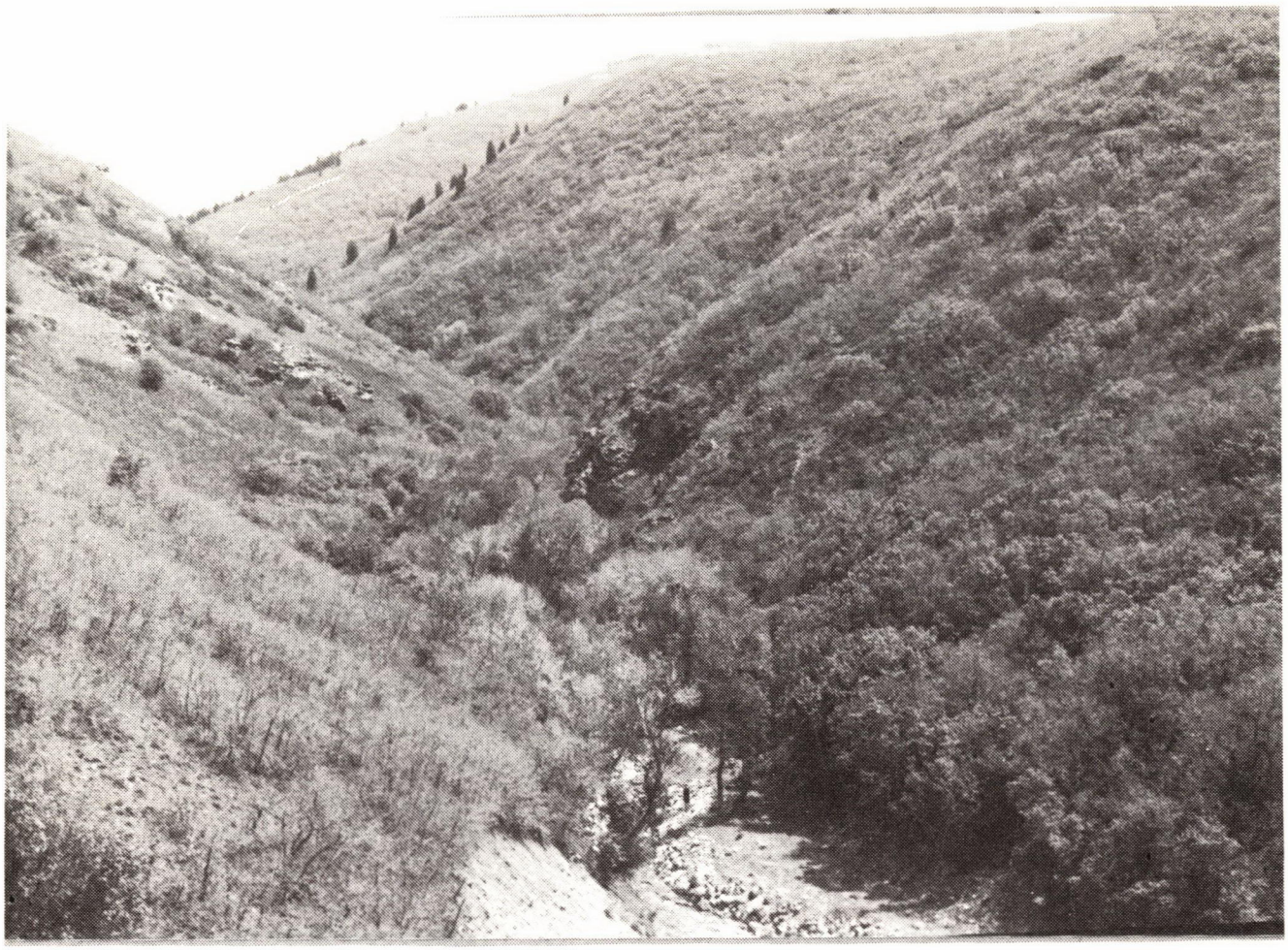

FIGURE 3 - Portion of Block DA-1 looking east into Holbrook Creek. Principal vegetation is Gambel oak (not fully foliated) and big leaf maple. Larger deciduous trees in stream bottom are cottonwood and box elder, 12-14 meters tall.

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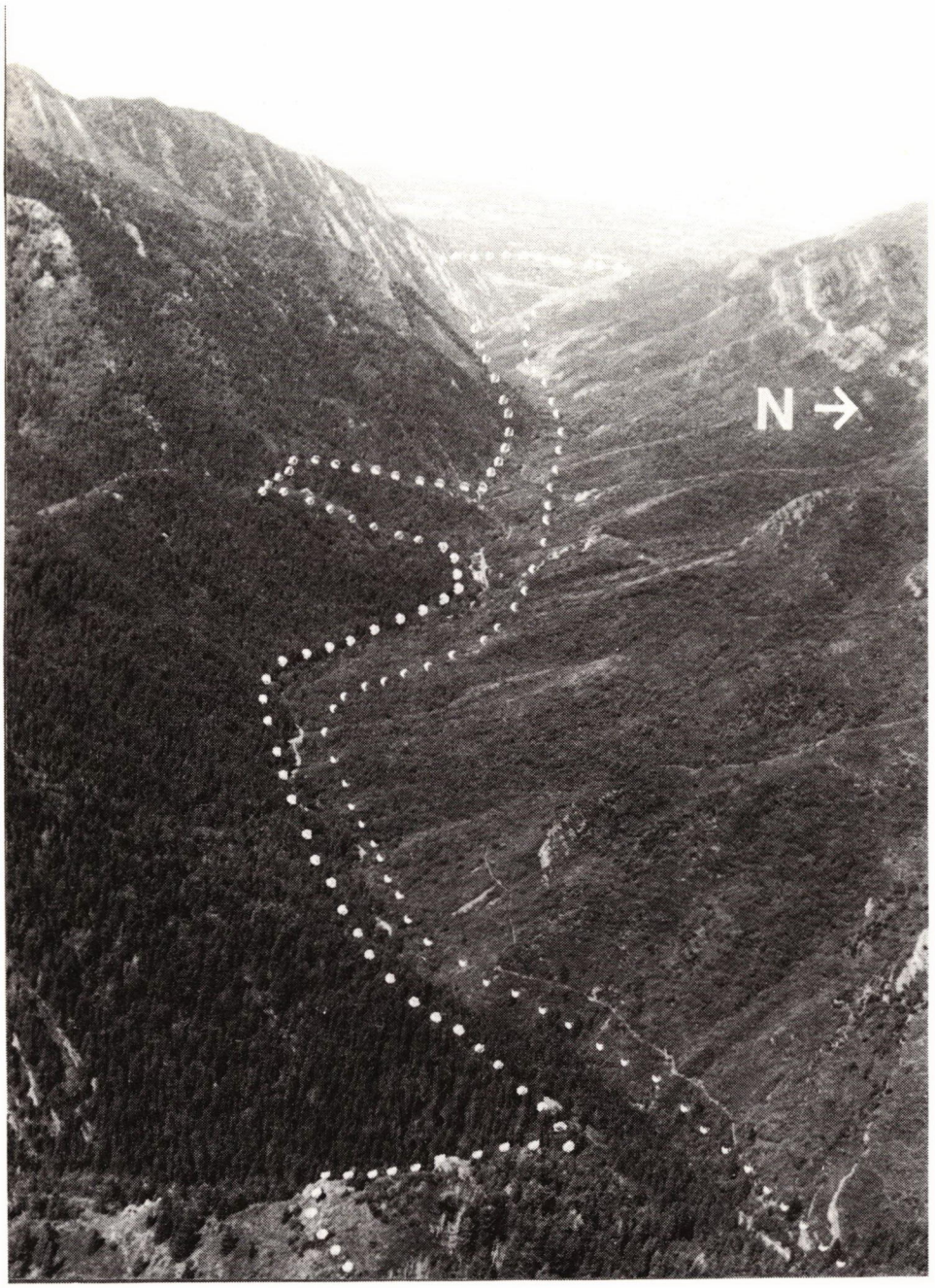

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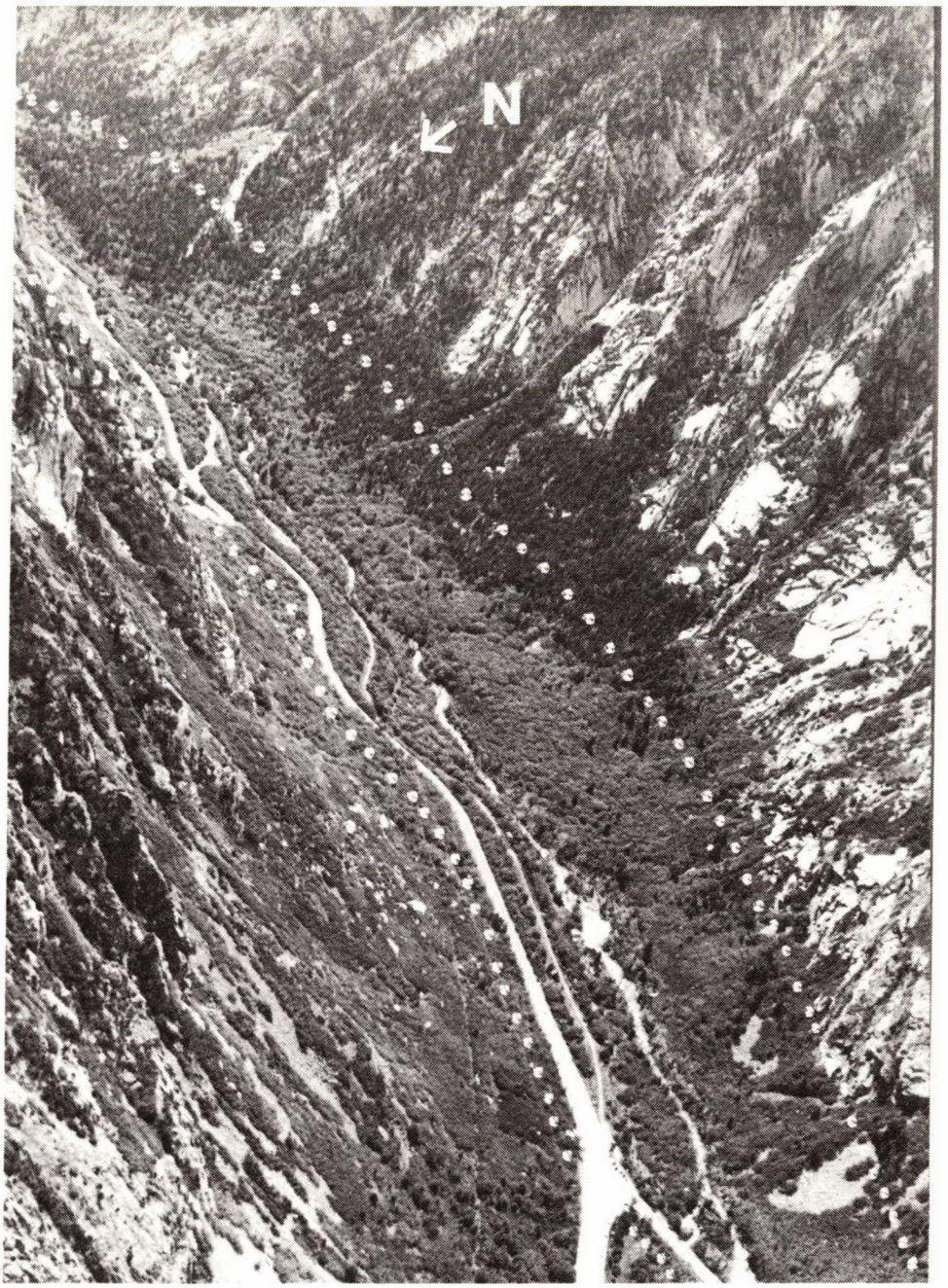

FIGURE 7 - Aerial photo of east half of Block SL-10 (Little Cottonwood Canyon). Canyon floor is typically riparian, dominated by cottonwood and box elder overstory. The laddered understory includes bigtooth maple, river birch, mountain alder and western chokecherry. (Figures 8 and 9). Small stands of deciduous trees near top of picture are aspen; conifer is white fir.

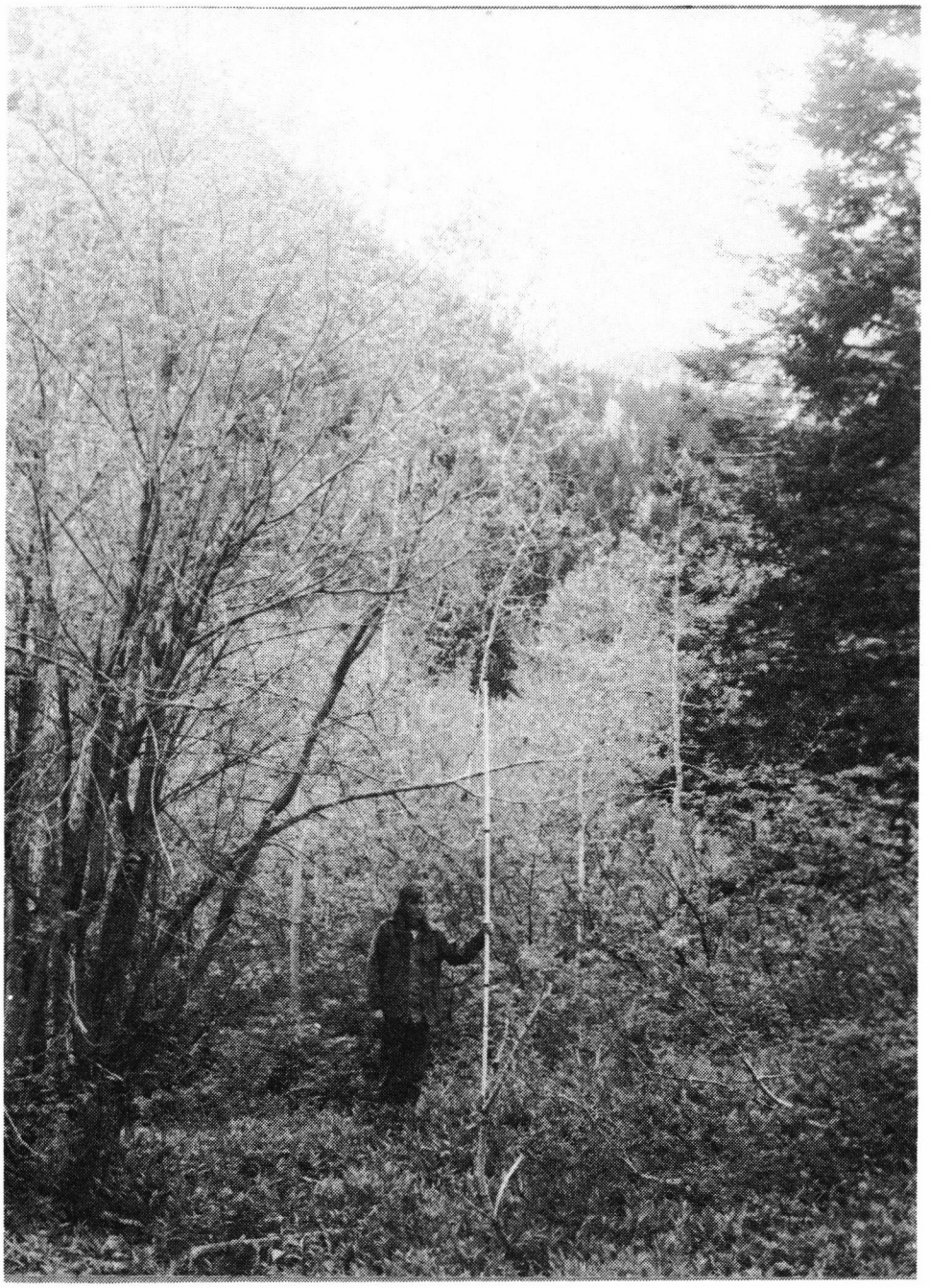

FIGURE 8 - In the bottom of Little Cottonwood Canyon (Figure 7). This multilevel riparian community includes cottonwood and box elder in the overstory; western chokecherry, bigtooth maple and aspen in the middle position; and river birch and mountain alder occupying the lower canopy level. Individual white firs are scattered throughout the block.

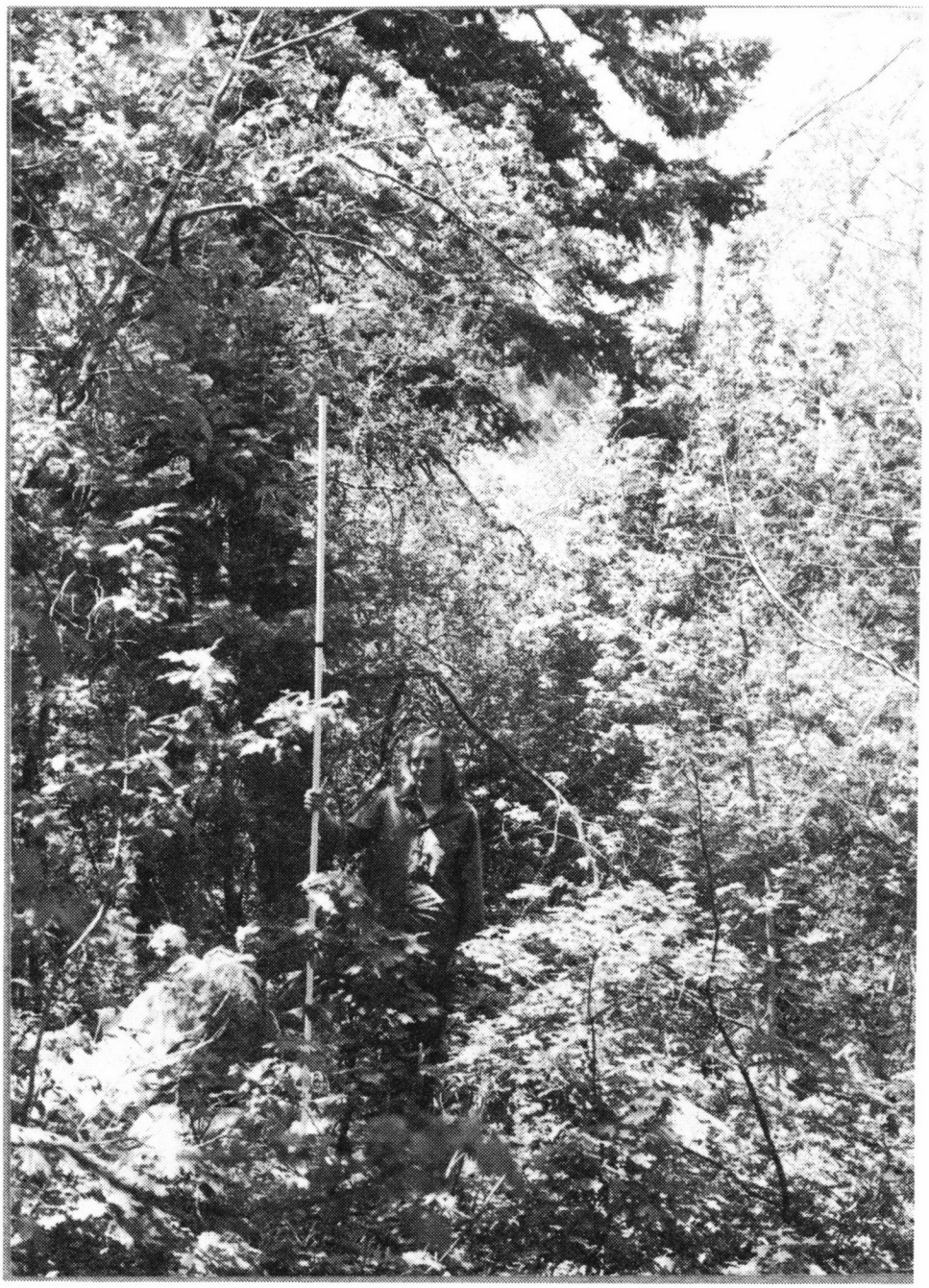

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FIGURE 11 - Example of vegetation in an established suburban community within Block SL-9.

FIGURE 12 - Portion of Block SL-11 showing suburban development along east bench. Major vegetation is Gambel oak (dense stands) and bigtooth maple. Ground cover in opening is sage brush, and small forbs and grasses.

FIGURE 13 - Aerial photo looking southeast into main part of Block UT-1. Major cover is Gambel oak with clumps of bigtooth maple and western chokecherry. Although the photo was taken 9 June, not all Gambel oak had completely refoliated, following two periods of killing frosts. Dark areas are stands of white fir.

FIGURE 14 - The principal cover in Block UT-1 (Figure 13) is this low growing, dense Gambel oak. The widely scattered deciduous trees are bigtooth maple and the conifers in background are white fir. The east spray boundary here coincides with the range of Gambel oak.

FIGURE 15 - South edge of Block UT-1, middle part of Rock Canyon. Deciduous vegetation is mainly bigtooth maple with some western chokecherry. Conifers on north slope (right) are white fir. Creek bottom is typically riparian.

FIGURE 16 - Large stands of almost pure bigtooth maple exist at higher elevations in portions of Block UT-1 (Figure 14). These trees, some exceeding 8 meters in height, have not completely foliated. Picture was taken 29 May, 1990.

Notes: